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ABSTRACT

A study involving 20 emotionally disturbed boys (9- to 11-years-old) was conducted to determine the effects of tactile and verbal reinforcement on attention to task and accuracy. Ss were given arithmetic problems to work during 16 20-minute sessions under four conditions: tactile reinforcement (intermittent touch pressure applied to Ss shoulders as they worked); verbal reinforcement (intermittent praise by the teacher); a combination of tactile and verbal reinforcement; and control treatment (no reinforcement cues). At the end of each period, scores were calculated for each S on both attention to task and accuracy of performance. Results showed that the combination treatment was most effective in producing high attention to task and high accuracy in problem solving; that tactile and verbal reinforcement alone ranked second and third in effectiveness; and that combination, verbal, and tactile treatments were all superior to the control with the exception that verbal reinforcement alone failed to produce higher problem solving accuracy. (Author/SB)

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THE EFFECTS OF TACTILE VS. VERBAL REINFORCEMENT ON ATTENTION TO TASK AND ARITHMETIC ACCURACY OF EMOTIONALLY DISTURBED BOYS

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Abstract

Ten emotionally disturbed white boys in a special education class each worked arithmetic problems under three experimental conditions and a control condition. The experimental conditions were: tactile reinforcement, consisting of touch pressure intermittently applied to the student's shoulders as he worked; verbal reinforcement, consisting of intermittent praise by the teacher; and a combination treatment including both praise and touch pressure. The combination treatment was more effective than any others in producing high attention to task and high accuracy in problem solving. Tactile and verbal reinforcement ranked second and third in effectiveness. All experimental treatments were superior to the control except that verbal reinforcement failed to produce higher problem solving accuracy.

THE EFFECTS OF TACTILE VS. VERBAL REINFORCEMENT ON ATTENTION TO TASK AND ARITHMETIC ACCURACY OF EMOTIONALLY DISTURBED BOYS

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Operant conditioning and reinforcement procedures have added new dimensions to classroom teaching and learning. The explorations of sensory modes of reinforcement carried out in recent years have demonstrated that changes in learning related behaviors in classroom settings can be effected.

Several investigations (Kish, 1955; Marx, Henderson, & Roberts, 1955) have demonstrated that subjects will perform a task or behavior in order to view visual stimuli. In addition, Siqueland (1968) found that visual reinforcements are effective in shaping and maintaining instrument behavior in infants from three weeks to one year of age. Greene and Hosts (1968) demonstrated that television pictures could be used to modify the behavior of a mildly retarded subject. Simmons (1964) demonstrated that auditory stimulation can be used to reinforce or shape behavior in infants, and Clearly and Packham (1968) used auditory reinforcement to teach reading and visual discrimination skills to normal and retarded children.

The effectiveness of food and taste, perhaps the most common sensory reinforcers, has been demonstrated in a variety of ways. For example, Haughton and Ayllon (1966) used food to modify a psychotic patient's deviant behavior. Hopkins (1968) used candy as a part of a reinforcement strategy to modify the behavior of retarded boys.

Tactile stimulation is virtually unexplored as a mode of sensory

reinforcement. However, the potential of tactile reinforcement has been suggested by several studies. Bailey and Meyerson (1969) used tactile vibrations as a reinforcement to alter the behavior of a profoundly retarded child, and Siqueland and Lipsitt (1966) used tactile stimulation on an infant's face to condition ipsilateral head movements. Recently, tactile cues and praise were used to reduce the incidence of undesirable classroom behaviors such as refusal to work, outbursts, and interference with peers with a group of emotionally disturbed adolescents (Clements & Tracy, 1974a) and tactile cues and verbal directions were found to increase the duration of attention to task in young retarded children (Clements & Tracy, 1974b).

There is little doubt that classroom teachers use many kinds of reinforcement in daily teaching. Verbal reinforcers such as praise and reprimand, and tactile reinforcers ranging from pats on the back to spanking are possible consequences of student behavior. However, it is doubtful that most teachers use verbal and tactile reinforcement systematically. Much teacher consequencing of student behavior is unplanned and sporadic. The present study investigated the effects of planned tactile and verbal reinforcement on desirable student behavior.

The purpose of the present study was to investigate the relative effects of tactile reinforcement, verbal reinforcement, a combination of both tactile and verbal reinforcement, and no reinforcement on two classroom behaviors, attention to task and accuracy in solving arithmetic problems. Both attention to task and accuracy in solving arithmetic problems are important classroom behaviors which most teachers desire to promote. In the present study the effects of tactile reinforcement alone on attention and accuracy were contrasted with the effects of verbal

reinforcement alone, a combination of both verbal and tactile reinforcement, and absence of reinforcement.

The research hypotheses were:

1. Verbal and tactile reinforcement, presented alone or in combination, result in higher levels of both attention to task and accuracy of performance than absence of reinforcement.
2. Tactile reinforcement results in higher levels of both attention to task and accuracy of performance than does verbal reinforcement.
3. A combination of tactile and verbal reinforcement results in higher levels of both attention to task and accuracy of performance than does either tactile or verbal reinforcement presented alone.

Subjects and Setting

The subjects for the present study were 10 white boys who had been previously diagnosed as emotionally disturbed and placed in a special class in a midwestern school district. The subjects ranged in age from 9 to 11 years. As part of the screening process for placement in the special class, each subject had been judged to be of normal intelligence based on the results of the Weschler Intelligence Scale for Children.

The special education classroom was operated under the structured approach (Haring & Phillips, 1962; Whelan, 1966). The subjects worked at individual desks which were spaced at least four feet apart. To reduce distractions, the work area of the classroom was separated by a partition from a free-time area in the same classroom. No changes in the classroom setting were introduced during the experiment.

The female teacher had established rapport with the students prior to the experiment. Routines and lesson plans which had been established were maintained. In order to accustom the students to his presence, the observer made frequent visits to the classroom prior to the beginning of the experiment. During those visits he acted as a teacher aide and practiced the observational techniques used later in the experiment.

Treatments

All treatments were delivered during 20-minute arithmetic work periods spread over 6 weeks. The teacher began each treatment period by providing the subject with a work sheet containing arithmetic problems appropriate to the subject's own level. The teacher instructed the student to work on the problems, and if the tactile, verbal, or combined tactile and verbal treatment was to be given, the teacher then delivered a cue to the subject.

To deliver the tactile cue, the teacher, after giving the student his assignment, stood directly behind the student, placed both hands on the student's shoulders midway between the shoulder and neck, and held this position for 3 to 5 seconds, pressing firmly. Uniformity of touch pressure was obtained in practice sessions prior to the experiment. The teacher delivered the verbal cue after presenting the assignment by standing immediately behind the student and saying, "I know, (student's name), you will do a good job on this assignment." To deliver the cue for the combination verbal and tactile treatment, the teacher delivered both the verbal cue and the tactile cue simultaneously following the instructions. No cue was given under the no-reinforcement treatment condition.

To deliver the tactile treatment, the teacher approached the student from the rear 4 minutes after the student had received the initial tactile

cue. Standing behind the student, the teacher placed her hands midway between the student's shoulders and neck and pressed firmly. To deliver the verbal treatment, the teacher approached the student from the rear 4 minutes after the initial verbal cue, stood directly behind the student without touching him and said either, "(Name), you are doing a good job," or, "(Name), you are doing a fine job." To deliver the combined verbal and tactile treatment, the teacher approached the student from the rear 4 minutes after the initial cue was delivered and delivered both the previously described verbal and tactile treatments simultaneously. In all experimental treatments, the treatment procedure was repeated three more times at 4-minute intervals during each 20-minute work period. Thus, treatments were given 4, 8, 12, and 16 minutes after the initial cue. In no case did the teacher deliver the treatment unless the student was attending to task. If the student was not working on his assignment, the teacher delayed the treatment until the student was attending again, and then delivered the treatment. Under the control treatment, no cues were delivered by the teacher again during the 20-minute work period. For all treatment conditions, the teacher picked up the student's work sheet at the end of 20 minutes without delivering further cues.

Every subject received each of the three experimental treatments on four different days and the control condition on four days during the experiment. Thus each subject was observed on a total of 16 different days. The order in which the subject received each of the 16 20-minute treatment periods was randomized independently for each subject. The teacher was able to deliver treatments to only two subjects during the same time period so the treatment periods were staggered throughout the morning sessions of the school day. Any effects due to order of treatment or time of day were

randomized. The treatments which were delivered during the same time period by the teacher were sometimes the same and sometimes different.

Observation and Measurement of Performance

The observer sat next to the teacher's desk in the front of the room where he could view the entire class. When data collection was not in progress, the observer assisted the teacher with classroom duties. During the treatment periods, the observer made judgements every 15 seconds as to whether each of the two subjects under observation was or was not attending to his assigned task. These judgements were recorded on a form described by Martin and Powers (1967). A subject was considered to be attending to task if he was looking at the assigned work, working problems, and recording responses. Non- attending behaviors included looking away from the assigned work by eye movements or head turning, bringing any object other than than necessary to do his assigned work into his field of vision, and making marks, such as doodling, which were not necessary for the assigned task.

Scores were calculated for each subject on both attention to task and accuracy of performance at the end of each experimental period. The student's score on attention to task during the 20-minute period was calculated by dividing the number of 15-second periods where he was judged to be attending to task, by 80, the number of 15-second periods in 20 minutes. The accuracy of this procedure was periodically checked by a second observer who observed each subject on six different days chosen at random during the experiment. Interobserver agreement for each session was calculated by dividing the smallest score by the largest score and multiplying the results by 100. This index of agreement ranged from 80 to 100 percent throughout the 60 concurrent observations, with a mean of 90 percent agreement.

Accuracy of performance was determined by scoring the arithmetic assignments, and dividing the number of problems correct by the total number of problems worked. Thus the score was the proportion of problems attempted which were correct. Since subjects were working at different levels, the assignments were not strictly comparable from subject to subject, but since the assignments for the same subject differed little in difficulty from day to day, and since the order of treatment was completely random for each subject, scores made by the same subject were comparable.

Analysis and Results

The data on attention to task and accuracy of performance on arithmetic problems were compiled for each of the 10 subjects for each of the 16 observation periods. Thus every subject had 4 observations under each experimental condition and 4 observations under the control condition. The data for both attention to task and accuracy were analyzed by an extension of the Friedman test described by Conover (1971, p. 273), which allows the analysis several observations under each of several conditions for each experimental subject or block. The method of adjusted significance levels (Ryan, 1960) was applied to make comparisons among each pair of treatments for both attention to task and accuracy of performance. The familywise error rate, the probability of at least one Type I error in a set of comparisons, was set at 5 percent for each dependent variable, making the probability of at least one Type I error in the entire experiment .10.

Table 1 shows the results of the analysis of the attention to task data. The hypothesis of equal probability of rank orders (Conover, 1971, p. 266) was rejected for the control treatment versus the combined tactile and verbal treatment, for the control treatment versus the tactile treatment, for the control treatment versus the verbal treatment, for the verbal

treatment versus the combined tactile and verbal treatment, and for the verbal treatment versus the tactile treatment. No other significant contrasts were found.

Insert Table I about here

Table II shows the results of the analysis of the arithmetic accuracy data. The hypothesis of equal probability of rank order was rejected for the combined verbal and tactile treatment versus each of the other treatments and for the tactile versus the control treatment. No other significant differences were detected. It should be noted that, although medians are reported, the Friedman test does not test the hypothesis of equal medians. Therefore, the magnitude of the difference in medians is not indicative of the magnitude of X^2_r.

Insert Table II about here

Discussion

Analysis of the data supported the research hypothesis that verbal and tactile reinforcement, presented alone or in combination, result in higher levels of attention to task than non-reinforcement. In addition, the hypothesis that tactile reinforcement results in higher levels of attention to task than verbal reinforcement was supported. The hypothesis that a combination of tactile and verbal reinforcement results in higher levels of attention to task than either verbal or tactile reinforcement alone was supported for verbal reinforcement, but a superiority of the combination of both verbal and tactile reinforcement over tactile reinforcement alone in increasing attention to task was not demonstrated

For the variable of accuracy of performance on arithmetic problems, the hypothesis that verbal and tactile reinforcement, presented alone or in combination, result in higher levels of performance than non-reinforced work was supported for tactile reinforcement alone and for tactile and verbal reinforcement combined, but not for verbal reinforcement presented alone. The hypothesis that tactile reinforcement results in higher levels of accuracy of performance was not supported. However, the combined tactile and verbal treatment resulted in levels of accuracy of performance on arithmetic problems which were significantly higher than each of the other three treatments.

The present study demonstrates a clear advantage for presenting both verbal and tactile reinforcement simultaneously to increase attention to task and accuracy of performance. Tactile reinforcement alone and verbal reinforcement alone rank second and third respectively in effectiveness.

The present study was limited to a single classroom and a single teacher. The experimental subjects were not atypical of the emotionally disturbed children found in many special education classrooms, but the extent to which the findings of the present study are generalizable to other kinds of emotionally disturbed students, to other kinds of special education students such as the mentally retarded, or to normal students is unknown and must be viewed with caution. Since all subjects were white males and the teacher was a white female, the experimental effects in other combinations of student sex and race or teacher sex and race are unknown. It is also possible that different age groups might react differently to tactile cues. Also, although the order presentation of the treatments was randomized for each subject and presumably would present no systematic bias, the possible cumulative effects of multiple treatments cannot be completely ruled out.

Despite the limitations cited above, the present study reveals a promising avenue of reinforcement which has received little previous attention and little systematic use by teachers. Most classroom teachers employ some verbal and tactile reinforcement in their daily teaching. However, much of this reinforcement is unplanned and haphazard. Applied in an unsystematic, haphazard manner, reinforcement may be mostly negative or not clearly linked as a consequence to behavior. The kinds of tactile and verbal reinforcement administered in the present study could be easily adopted by classroom teachers since no special apparatus, tokens, point keeping systems, or special training is required.

The present study may also bring into question whether verbal and tactile teacher contact have been adequately controlled in some studies where tokens and tangible rewards have been used as reinforcers. Further research into the conditions under which tactile reinforcement is optimally effective and experiments with different combinations of settings, student populations, and teacher populations are needed.

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TABLE I

Medians and Semi-Interquartile Ranges of Percentages and Calculated X_T^2 Values for Comparisons between Treatments on Attention to Task (N = 10)

Treatment	MDN	Q	Friedman X_T^2 for Comparisons		
			(2)	(3)	(4)
(1) Control	68.5	9.00	5.42*	45.63**	52.01***
(2) Verbal	73.0	6.50		31.01*	46.88**
(3) Tactile	88.0	5.25			4.80
(4) Tactile & Verbal	88.5	4.00			

*p < .0250

**p < .0125

***p < .0083

TABLE II

Medians and Semi-Interquartile Ranges of Percentages and Calculated X_r^2 Values for Comparisons between Treatments on Accuracy of Arithmetic Problem Solving (N = 10)

Treatment	MDN	Q	Friedman X_r^2 for Comparisons		
			(2)	(3)	(4)
(1) Control	65.0	13.50	3.01	20.01**	39.68***
(2) Verbal	76.0	12.25		4.41	14.70**
(3) Tactile	85.5	7.00			6.77*
(4) Tactile & Verbal	91.5	5.50			

*p < .0250

**p < .0125

***p < .0083